SWP 28/92 THEORETICAL AND METHODOLOGICAL ISSUES CONCERNING MANAGERS' MENTAL MODELS OF COMPETITIVE INDUSTRY STRUCTURES

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ABSTRACT

The methodology traditionally employed by strategic groups theorists categorizes companies on the basis of objective economic variables such as industry supply characteristics. Other lines of research have suggested that this economic approach is limited, and that a more cognitive approach is needed. Strategic groups theory proposes one way in which companies may be categorized, but it is not clear to what extent mangers categorize their competitors.

This paper is concerned with both the theoretical and methodological issues concerning how and if managers categorize their competitors. The paper begins with a review of the theory and evidence concerning the psychological process of categorisation, from the areas of cognitive psychology and management science. These areas have been dominated by a model that suggests that managers categorize their competitors in a simple hierarchical manner. Research conducted with managers and experts from other fields suggests that expertise is generally associated with more complex, context-dependent mental models.

The paper reviews methods used to elicit the structure of managerial mental models. The hierarchical card sorting technique used by Porac and his associates is predicated upon the hierarchical theory of mental models. Therefore, this technique may be too context insensitive. The repertory grid procedure and another recently developed card sorting method are shown to be suitably flexible to allow context sensitive representations of managerial mental models to be constructed. However, the statistical operations associated with the repertory grid procedure can involve a certain amount of researcher interpretation.

STRATEGIC GROUPS THEORY

Strategic groups theory implies that organisations within an industry may be categorized into groups on the basis of similarities in their strategic characteristics (see McGee and Thomas, 1986 for a review). It has been found that organisations can indeed be categorized on this basis (McGee and Thomas, 1986). Strategic groups theory indicates one way in which competition within an industry may be described. Those organisations that are following similar strategies should be in the closest competition.

However, strategic groups theory is subject to two limitations. From a theoretical perspective, it is not clear whether managers categorize organisations within their industry according to the strategies that they follow, or as external observers consider them to follow. Indeed, it is not clear to what extent managers categorize their competitors, if at all (see below). Also, the methodology traditionally used in strategic groups analysis has been based on economic indicators (McGee and Thomas, 1986). Managers may also use economic variables to categorize their competition, but this too is unclear.

In short, it is not clear whether past applications of strategic groups theory matches the implicit mental models possessed by managers (Thomas and Venkatraman, 1988). This underlines other lines of research which indicate that an economic approach to strategy may be limited, and that a more cognitive approach may be needed (Porac and Thomas, 1989, Stubbart, 1989, Huff, 1990).

It is clear that managers store knowledge about a company or product in memory. Decisions made concerning products and companies will then be made on the basis of information stored in memory (Baddeley, 1983).

Therefore, an useful area of research would be an investigation of how managers represent and store knowledge concerning the competitive relationships between companies within a given industry.

PSYCHOLOGICAL THEORIES OF CONCEPT REPRESENTATION

This section is organised in the following manner: General models of memory are reviewed and models of concept representation are reviewed first. These models are contrasted with evidence from research conducted with managers. To the extent that managers may be considered to be experts within a given field, research conducted with experts from other domains is also reviewed.

Theories of memory and concept organisation.

Memory can be divided into long term and short term memory (Baddeley, 1983). Short term memory processes information for storage and retrieval in long term memory. Therefore, one function of short term memory is to access information for decision making from long term memory (Baddeley, 1983). Since short term memory has a limited capacity (Miller, 1956), the structure of long term memory will influence what information is accessed about a given concept. Hence, managerial decision making will be influenced by the structure of long term memory.

It is generally agreed that information is represented in long term memory by a set of organising principles that group events and concepts together in terms of contiguity (Schank, 1982, Schacter, 1989). This contiguity may refer to two concepts being associated by time, function or attributes shared. These organising principles have been labelled, for instance, schemata (Bartlett, 1932), mental models (Johnson-Laird, 1989) and scripts (Schank, 1982). According to this view, a manager has a mental model for each of the companies that she sees her firm as

being in competition with. Therefore, it is important to determine how these different mental models are related in memory.

The most efficient way to represent information about a concept or object in memory is in a hierarchy (Charniak and McDermott, 1985). Efficiency is maximized when information is represented only once, therefore redundancy of information is eliminated. Collins and Quillian (1969) proposed a model of memory based upon this premise. Their model suggests that a person represents information in a semantic network, arranged in a hierarchy. A semantic network is a network of nodes, connected by arcs (Stubbart, 1989). Nodes represent concepts, objects, ideas, adjectives etc., whilst arcs represent the association between two nodes.

The network is arranged such that information about an object is abstracted at higher levels in the network. For instance, a manager may represent abstract information about an industry at a higher level of the hierarchy. At lower levels of the hierarchy, more specific information about particular companies is represented. According to this theory, memory is organised by a hierarchical category structure.

Collins and Quillian's theory suggests that there exist necessary and sufficient attributes for an object to belong to a particular category. Therefore, category membership is either "all or none". This model, along with other similar models, may be called the classical model (Medin, 1989).

Smith *et al* (1974) have criticized Collins and Quillian. They suggest that the Collins and Quillian model cannot handle those circumstances in which a concept can be a member of a category, but not share all the necessary defining features of that category. Moreover, they

suggest that the structure of memory does not determine how concepts are retrieved from memory, but retrieval is based upon the salience of the features of the concept to be retrieved. Concepts with salient features are thought to be accessed from memory more readily. Nevertheless, a hierarchical network is thought to influence this feature based retrieval process (Collins and Loftus, 1975).

Mervis and Rosch (1981) have proposed one way in which knowledge about objects may be represented in this hierarchy. They suggest that a domain of knowledge can be organised into three levels of a hierarchy, a superordinate level, a basic level and a subordinate level. Information about the concepts of objects within that domain is represented at each level of the hierarchy. For instance, all grocery retailers may represent the superordinate level. Local versus national grocery retailers may represent two basic levels, and specific store names may represent the subordinate level. According to Mervis and Rosch, objects are categorised, according to similarity, at each level of the hierarchy. Each of these categories is assumed to be associated with a set of descriptors for that category (cf. Collins and Quillian, 1969, Collins and Loftus, 1975).

Mervis and Rosch suggest that the basic level is intermediate between the superordinate and subordinate level. However, the basic level is the level at which with within-category similarity is maximized with respect to between-category similarity. For instance, many local grocery retailers have much in common relative to national grocery retailers. Thus, Mervis and Rosch predict that information from the basic level should be retrieved more easily than from either the subordinate or superordinate categories. Hence, according to Mervis and Rosch, decisions made by managers should be made more readily on the basis of information from basic level

categories of competitors, rather than on the basis of information concerning the whole industry (superordinate level), or individual firms (subordinate level).

Mervis and Rosch (1981) also suggest that objects are categorized according to their overall similarity to a prototypical member of that category. Some members of a category may be closer to this prototype than others. Category members that are similar to the prototype share many features of the prototype. Similarity to the prototype is assessed by the extent to which the prototype and the category member share attributes that define the category. Thus, unlike Collins and Quillian's classical model, the Mervis and Rosch model is probabilistic.

Mervis and Rosch suggest that objects are categorised according to a prototype, which is an ideal example of that category. For instance, a category of national grocery retailers may have an ideal example based upon the features Tesco and Sainsbury have in common. This type of theory is called the prototypical view.

Other theorists have suggested that objects are categorised according to the similarity they share with an exemplar (see Medin, 1989, for a review). An exemplar may defined as a good example of the category. For instance, the category of national grocery retailers may now be represented by either Tesco or Sainsbury, since they are both good examples of this category. This type of theory may be called the exemplar view.

However, both variants (exemplar and prototype) assume categorisation takes place on the basis of comparisons between some referent typical of the category, and that categories are arranged in a hierarchical structure (Medin, 1989).

The Mervis and Rosch theory has received some criticism. The theory makes no statements regarding in which ways context may alter how objects are categorised (Medin, 1989). Also, the theory does not distinguish between the effects of differing types of descriptors upon categorisation (Barr and Caplan, 1985, Barr and Caplan, 1987, Caplan and Barr, 1991). Most importantly, it is not clear whether objects "belong to the same category because they are similar (or whether) they seem similar because they are in the same category" (Medin, 1989, pg 1473).

Nevertheless, the basic tenets of the theory have been supported by experimental and anthropological research (Mervis and Rosch, 1981, D'Andrade, 1989). These are that concepts and objects are categorised, and that these categories are arranged in a hierarchy. Moreover, this model has been predominant in both psychology and in management theory over the past 10-15 years. Therefore, the rest of this paper will be focused upon the adequacy of the model for management research.

In the following sections, the adequacy of Mervis and Rosch's theory will be assessed in regard to its application to strategic management science. Insofar that top managers are experts at making strategic decisions, research into expert knowledge is also relevant to this discussion.

Managers' mental models of competitive industry structures.

Mervis and Rosch's theory of categorisation has been advocated for use in strategic management research (Dutton and Jackson, 1987, Porac and Thomas, 1990). The paper written by Porac and Thomas (1990) is of special relevance. In their paper, Porac and Thomas state that an understanding of top managers mental models of the

competitive environment will enable a fuller understanding of strategic responses to competitive pressures.

Basing their arguments on Mervis and Rosch's categorisation theory, Porac and Thomas present a number of propositions of how managers organise information concerning their competitors. Three of these are especially relevant to how managers perceive the relationships within competitive industry structures. The first of these is that managers make sense of their competitive environment by developing cognitive hierarchical taxonomies that summarize the similarities and differences between competitors.

Evidence for this proposition has been provided by Porac *et al* (1989) and Hodgkinson and Johnson (1991). Both studies found that managers can represent the structure of an industry by hierarchical taxonomic categories. However, both studies used a methodology that directed managers to organise their cognitions in a hierarchical manner. Thus the evidence for the proposition may be equivocal.

Moreover, Hodgkinson and Johnson (1991) found that managers mental models of the competitive environment may be specific to particular contexts. As noted in the previous section, one criticism of Mervis and Rosch's theory is that it cannot yet account for changing mental models with changing contexts.

The second proposition that is relevant here suggests that managers match an organisation to a category at the basic level in the hierarchy of categories (recall that the basic level is intermediate between the sub-ordinate and super-ordinate categories, Mervis and Rosch, 1981). Porac and Thomas (1988) asked managers to spontaneously categorise organisations. They found that managers

placed organisations in intermediate categories, previously elicited from the managers, suggesting that managers categorise competitors initially at the intermediate basic level. This result would appear to support Porac and Thomas' proposition (1990).

The final proposition that is relevant here suggests that organisations placed within a category are perceived to be in closer competition with each other than other organisations. Gripsud and Gronhaug (1985) reported that grocery store managers within a small town perceived a small fraction of the total number of grocery stores as competitors. This result would also seem to support Porac and Thomas' proposition. However, that only a small fraction potential competitors were listed as competitors does not necessarily mean that competitors have been categorized.

The evidence from the management literature is equivocal regarding the utility of Mervis and Rosch's theory of categorisation. Although the predictions made by Porac and Thomas (1990) based upon Mervis and Rosch have been supported by the data, methodological artifacts can just as easily account for many of the results. Moreover, the data presented by Hodgkinson and Johnson (1991) indicate that the theory is not sensitive to differing contexts.

Expert knowledge.

Managers may be considered experts in a particular domain of knowledge. Therefore, a review of the literature on expert knowledge is relevant to this discussion. Gilhooly (1990) considers that there are five *maxims* of expert knowledge. These are; experts remember better; experts work forwards to a problem solution; experts have superior understanding of problems; experts are superior in knowledge, not basic capacities; experts become expert through extensive practice.

Most of these maxims indicate that experts have a memory for their domain of expertise that is better organised than that of the novice, but also contains richer and more complex information (Gilhooly, 1990).

Three studies are relevant to this discussion, since they have tested aspects of Mervis and Rosch's theory of categorisation in relation to experts. Gammack (1987), in an in-depth study of an amateur train enthusiast, found that a hierarchical taxonomy did not represent the expert's knowledge of trains as efficiently as a non-taxonomic category structure, since the hierarchical structure contained much redundant information. Similarly, Tanaka and Taylor (1991) found that both bird and dog experts categorise just as efficiently at both the subordinate and basic (intermediate) levels of the hierarchy proposed by Mervis and Rosch. Mervis and Rosch (1981) stress that categorisation should be more efficient at the intermediate basic level. Murphy and Wright (1984) found that expert clinical psychologists readily described diagnostic categories in terms of overlapping attributes, although novices did not. Mervis and Rosch's theory would predict that attributes should not overlap, since basic level categories minimize between-category similarity.

All these studies suggest that experts categorise at the subordinate level of Mervis and Rosch's hierarchy, rather than the basic level.

However, some evidence suggests that experts may have more simple mental models than novices. Expert fighter pilots may have less complex mental models of their aeroplane than novice fighter pilots (Schvaneveldt *et al*, 1982). It may be that experts in very complex knowledge domains (such as fighter planes) organise their knowledge

on the basis of simplifying heuristics. These heuristics are derived by excluding very unlikely associations.

Taken together, the results of the studies listed suggest, that on the whole, experts do not have hierarchical taxonomic mental models of their expert knowledge domain. The complexity of the mental model may be contingent upon the complexity of the knowledge domain. Therefore, the research reviewed in this section may indicate that the complexity and structure of the mental models of the environment that are held by managers may be contingent upon the nature of the knowledge being represented.

Porac and Thomas (1988) did find evidence supportive of Mervis and Rosch (1981). It will be recalled that their respondents spontaneously categorized target companies at the basic level of a derived hierarchy. These results may suggest that expert knowledge research is not relevant for managerial research, and that Mervis and Rosch's theory is an adequate model of managerial categorisation processes. Recall however, that Porac and Thomas used a sample of grocery store managers in a small American town. It is doubtful whether grocery store managers have access to the same expert knowledge of an industry as, for example, the chief executive officer of a large petrochemical firm. Thus, the mental models of managers may be dependent upon their expertise in a given industry or market.

The current state of categorisation.

The evidence presented in this paper has indicated that the model of categorisation presented by Mervis and Rosch (1981) may not be wholly appropriate for understanding how managers categorize organisations that are in competition with each other.

Firstly, mental models have been found to be context dependent (Hodgkinson and Johnson, 1991). The categorisation theory advanced by Mervis and Rosch cannot easily incorporate these findings (Medin, 1989). Exemplar theory, where instances of a category are dependent upon resemblance to a good example of that category, rather then an ideal prototype, can deal with this context dependency (Medin, 1989). Quite simply, as the context changes, so does the best example of that category.

However, there are two problems with exemplar theory. Firstly, it is subject to many of the same criticisms as prototype theory, since exemplar theory is also based on the premise of hierarchical mental models and feature matching (Medin, 1989, see above).

Secondly, the contingencies of the situation may dictate which type of categorisation theory is the most appropriate model. Cohen and Basu (1987), in an analysis of categorisation theory applied to consumer behaviour, consider that prototype theory may be more appropriate when the consumer has time compare all the attributes of the target instance with the prototype, and is also motivated to do so. In contrast, Cohen and Basu (1987) consider exemplar theory to be more appropriate when the consumer is constrained by time and complex information. Thus, Cohen and Basu (1987) consider the form of categorisation to be context dependent. It is not clear whether their arguments are relevant to managers.

A review of the relevant literature on expert knowledge has questioned the hierarchical nature of the Mervis and Rosch model. The results of studies conducted in this field suggest that experts maybe more likely to use subordinate level categories to classify objects in their field of expertise (Murphy and Wright, 1984, Gammack,

1987, Tanaka and Taylor, 1991). Results also suggest that expert knowledge does not necessarily imply more complex mental models of a domain, especially if that domain is very complex (Schvaneveldt *et al*, 1982).

According to these results, a hierarchical model of categorisation may be appropriate for managers in local and stable environments (cf. Porac and Thomas, 1988), since these types of managers are not required to understand complex industry structures. However, managers in more complex and diverse industries should have mental models of the industry structure that are less hierarchical and more complex. Very complex environments may even lead to managers with simplified mental models of the competitive relations between companies within an industry.

Recent developments have suggested that categorisation, in part, may be made upon the basis of presumed causal relations between objects (Medin, 1989). That is, people categorize on the basis of their knowledge of the world, rather than or as well, as matching features to some referent value represented in memory (Lyon and Chater, 1990, Vandierendonck, 1990). Thus, a manager may place two companies in the same category, not because they share features in common, but because s/he knows that these companies are in close competition.

It is likely that categorisation actually takes place upon the basis of both feature matching and presumed knowledge about the world (Medin, 1989). It is also likely that both exemplars and prototypes may be appropriate mental referents in differing circumstances. Moreover, the structure of mental models may also change with circumstances.

Thus, the structure and form of managers' and mental models of competitive industry structures is dependent

upon a large array of contingencies. It is probable that only a few of the very many variables that may affect categorisation have been touched upon here, and possibly in the literature as a whole. Therefore, it would seem that a contextual approach is required to understand mental models of competitive industry structures.

A methodology that makes minimal assumptions concerning the structure of mental models is required to supplement this theoretical approach. In the following section, three methods for representing managers' mental models are described. Their adequacy is assessed by the assumptions they make about mental models.

METHODS FOR REPRESENTING MANAGERS' MENTAL MODELS

Methods for representing the structure of mental models have become increasingly popular in a number of research areas (eg. Olson and Reuter, 1987), including management science (Huff, 1990). These representations have become known as cognitive maps (Huff, 1990).

Two methods have been predominantly used to assess the structure of managers' mental models of competitive industry structures (Huff, 1990). These are complex statistical operations performed with Kelly's repertory grid (Kelly, 1955, Fransella and Bannister, 1977, used by Reger, 1987 and Walton, 1986) and hierarchical taxonomic categorisation techniques (eg. Porac *et al*, 1989, Hodgkinson and Johnson, 1991). In the following sections, both of these techniques will be reviewed. Another technique, recently developed by ourselves will also be reviewed.

Hierarchical taxonomic sorting techniques.

Porac and his colleagues (eg. Porac and Thomas, 1987) have devised a set of interview procedures based upon Mervis and Rosch's theory of categorisation (outlined above). Variations of the technique can be used to construct individual taxonomies, or taxonomies representing the collective cognitive structure of the research participants.

The technique used for individual taxonomies, asks the participant to identify various sub-categories of businesses which stem from a beginning category. This beginning category, known as the "root beginner", is provided by the researcher. Further sub-categories are elicited by the participant, until no further meaningful sub-categories can be identified.

Aggregate maps are assembled in a similar way. In this case, different individuals' taxonomies are amalgamated by an independent panel of experts. Further samples of participants are then used to identify sub-categories. Again, the process is repeated until no further meaningful sub-categories can be identified.

One of the problems with these techniques is that they assume that mental models follow a hierarchical taxonomic structure. However, as was discussed above, a persons' mental model does not necessarily follow a hierarchical taxonomic structure. In the case of experts, mental models may have a much "flatter" structure. Moreover, these techniques can be context insensitive and do not elicit any reasons for the way in which the taxonomies are derived.

Therefore, methods that do not assume a given structure of mental models are perhaps more suitable. Also, such methods should elicit reasons for why the participant

represents her knowledge in a given way. One such technique is the repertory grid.

The repertory grid technique.

The repertory grid is a flexible technique for eliciting a person's mental model of a given domain. Although the technique is predicated by Kelly's construct theory (1955), it is not necessary to accept the underpining theory in order to use the technique (Smith and Stewart, 1977). Therefore, the technique can be used with no assumptions concerning the structure of a person's mental model.

The first stage of the technique involves eliciting the concepts, *or elements*, in the domain of interest. For instance, this may involve asking the participant to name all the companies within a given industry that she believes her firm is competing with.

The next stage involves eliciting *constructs*. Constructs are the qualities that people use to think about the elements. In other words constructs are the descritpors of the elements. In order to elicit the constructs, the method of triading is most often used. In triading, three cards are drawn at random. The respondent is then asked to indentify the two companies that are most similar. The respondent is then asked to state how these two are different from the third. Each of the constructs is written down on a card. This process is usually continued until constructs are repeated or the respondent can give no more constructs.

The elements and constructs are then arranged into a grid. The respondent then rates or ranks each of the elements on each particular construct.

recorded and written down. From these sources of data, a map may be constructed that composes of the way in which the companies were arranged, together with the descriptors used to label those companies.

Although the focus of this paper is to describe how to construct maps of peoples' mental models, it is possible to gather other data from the visual card sorting technique. The complexity of a person's mental model may be assessed by the number of maps she produces, the number descriptors she gives and the average number of categories per map. Such data may be used in other analyses.

Thus the technique described allows the respondent to categorize and sub-categorize companies if that is the way her mental model is arranged. However, the technique does not force her to do this, and does allows for maps to be constructed that do not involve categories. Moreover, the elicitation of multiple maps from the same respondent overcomes context insensitivity. Finally, like the repertory grid technique, the technique elicits reasons for the structure of the mental model.

SUMMARY AND CONCLUSIONS

The paper began with a review of the literature concerned with how managers represent information concerning other companies. Although the dominant model in both cognitive psychology and management science has been a probabilistic hierarchical model of knowledge representation, special considerations indicate that managers do not necessarily represent knowledge in a hierarchy of concepts. Empirical evidence from studies with experts suggests that not all managers represent their knowledge in a hierarchy.

The second section of this paper examined the methods that may used to uncover the structure of managerial mental models. The taxonomic categorisation technique employed by Porac and his associates may be too inflexible to construct satisfactory cognitive maps.

In contrast, the repertory grid is flexible and can elicit reasons for the structure of the map. However, the map is derived from complex statistical operations on the raw data. Thus, a certain amount of researcher interpretation is required to construct the map.

A simple visual card sorting technique, described here, may offer an alternative to the repertory grid. Like the repertory grid, it elicits reasons for the structure of the map. It is also sensitive to differing contexts. Unlike the grid, the technique requires the participant to categorize and arrange the concepts in the domain investigated.

However, we do not, as yet, recommend the blind adoption of this technique. At present, we are engaged in research to determine the validity of the technique in comparison to the repertory grid by comparing maps elicited by both methods. Moreover, studies that use more than one method to gather data are far more likely to produce robust findings (Cook and Campbell, 1976). Therefore, at the moment, we think it is best to use the visual card sorting technique in conjunction with the repertory grid technique.

REFERENCES

Baddeley, A. (1983). *Your Memory: A User's Guide*. Middlesex: Penguin.

Barr, R.A., Caplan, L.J. (1985). Two kinds of feature ? A test of two theories of typicality effects in natural language categories. In *Proceedings of the 7th Annual Conference of the Cognitive Science Society*. London: Erlbaum.

Barr, R.A., Caplan, L.J. (1987). Category representations and their implications for category structure. *Memory and Cognition*, **15**, 397-418.

Bartlett, F.C. (1932). *Remembering*. London: Cambridge University Press.

Caplan, L.J., Barr, R.A. (1991). The effects of feature necessity and extrinsicity on gradedness of category membership and class inclusion relations. *British Journal of Psychology*, **82**, 427-440.

Charniak, E., McDermott, D. (1985). *Introduction to Artificial Intelligence*. Reading, Massachusetts: Addison:Wesley.

Cherniak, C. (1984). Prototypicality and deductive reasoning. *Journal of Verbal Learning and Verbal Behavior*, **23**, 625-642.

Cohen, J.B., Basu, K. (1987). Alternative models of categorization: Toward a contingent processing framework. *Journal of Consumer Research*, **13**, 455-472.

Collins, A.M., Loftus, E.F. (1975). A spreading activation theory of semantic processing. *Psychological Review*, **82**, 407-428.

Collins, A.M., Quillian, M.R. (1969). Retrieval time from semantic memory. *Journal of Verbal Learning and Verbal Behavior*, **8**, 240-247.

Cook, T.D., Campbell, D.T. (1976). The design and conduct of quasi-experiments and true experiments in field settings. In M.D. Dunnette, *Handbook of Industrial and Organisational Psychology*. Chicago: Rand McNally.

D'Andrade, R.G.D. (1989). Cultural cognition. In M.I. Posner (ed.), *Foundations of Cognitive Science*. Cambridge, Massachusetts.

Dutton, J.E., Jackson, S.E. (1987). Categorizing strategic issues: Links to organizational action. *Academy of Management Review*, **12**, 76-90.

Everitt, B. (1980). *Cluster Analysis*. New York: Halstead.

Fransella, F., Bannister, D. (1977). *A Manual for Repertory Grid Technique*. London: Academic Press.

Gammack, J.G. (1987). Modelling expert knowledge using cognitively compatible structures. In *The Proceedings of the Third International Expert Systems Conference*. Oxford: Learned Information.

Gilhooly, K.J. (1990). Cognitive psychology and medical diagnosis. *Applied Cognitive Psychology*, **4**, 261-272.

Gripsud, G., Gronhaug, K. (1985). Structure and strategy in grocery retailing: A sociometric approach. *Journal of Industrial Economics*, **33**, 339-347.

Hodgkinson, G.P., Johnson, G. (1991). Exploring the mental models of competitive strategists: The case for a

processual approach. Paper submitted to *Journal of Management Studies*.

Huff, A.S. (1990). *Mapping Strategic Thought*. Chichester: Wiley.

Johnson-Laird, P.N. (1989). Mental models. In M.I. Posner (ed.), *Foundations of Cognitive Science*. Cambridge, Massachusetts.

Kelly, G.A. (1955). *The Psychology of Personal Constructs*. Vols 1 and 2. New York: Norton.

Lyon, K., Chater, N. (1990). Localist and globalist approaches to concepts. In K.J.Gilhooly, M.T.G.Keane, R.H.Logie, G.Erdos (eds.), *Lines of Thinking: Reflections on the Psychology of Thought*, Vol.1. Chichester:Wiley.

McGee, J., Thomas, H. (1986). Strategic groups: Theory, research and taxonomy. *Strategic Management Journal*, **7**, 141-160.

McKeown, B., Thomas, D. (1988). *Q-Methodology*. Sage University Paper series on Quantitative Applications in the Social Sciences, series no. 07-066. Beverley Hills: Sage.

Medin, D.L. (1989). Concepts and concept structure. *American Psychologist*, **44**, 1469-1481.

Mervis, C.B., Rosch, E. (1981). Categorization of natural objects. *Annual Review of Psychology*, **32**, 89-115.

Miller, G.A. (1956). The magic number seven, plus or minus two: Some limitations on our capacity for processing information. *Psychological Review*, **63**, 81-97.

Murphy, G.L., Wright, J.C. (1984). Changes in the conceptual structure with expertise: Differences between real-world experts and novices. *Journal of Experimental Psychology: Learning, Memory and Cognition,* **10**, 144-155.

Olson, J.R., Rueter, H.H. (1987). Extracting expertise from experts: Methods for knowledge acquisition. *Expert Systems,* **4**, 152-168.

Porac, J.F., Thomas, H. (1987). Cognitive taxonomies and cognitive systematics. *Paper presented at the annual meeting of the academy of management,* New Orleans, August.

Porac, J., Thomas, H. (1988). Cognitive taxonomies in managerial competitive sensemaking: Evidence from retailing. Paper presented at the conference on Information Processing in Organizations, State University of New York-Buffalo.

Porac, J.F., Thomas, H. (1989). Managerial thinking in business environments. Journal of Management Studies, **26**, 323-324.

Porac, J.F., Thomas, H., Baden-Fuller, C. (1989). Competitive groups as cognitive communities: The case of Scottish knitwear manufacturers. *Journal of Management Studies,* **26**, 397-416.

Porac, J.F., Thomas, H. (1990). Taxonomic mental models in competitor definition. *Academy of Management Review,* **15**, 224-240.

Rips, L.J. (1975). Inductive judgements about natural categories. *Journal of Verbal Learning and Verbal Behavior,* **14**, 665-681.

Schank, R.C. (1982). *Dynamic Memory*. London: Cambridge University Press.

Schacter, D.L. (1989). Memory. In M.I. Posner (ed.), *Foundations of Cognitive Science*. Cambridge, Massachusetts.

Schvanveldt, R.W., Anderson, M., Breen, T.J., Cooke, N.M., Goldsmith, T.E., Durso, F.T., Tucker, R.G., DeMaio, J.C. (1982). *Structures of Memory for Critical Flight Information*. Air Force Human Resource Laboratory, Technical Report 81-46.

Smith, E.E., Shoben, E.J., Rips, L.J. (1974). Structure and process in semantic memory. *Psychological Review,* **81,** 214-241.

Smith, M. (1986). An introduction to repertory grids - part two: Interpretation of results. *Graduate Management Research,* Autumn, 4-24.

Smith, M., Stewart, B.J.M. (1977). Repertory grids: A flexible tool establishing the content and structure of a mangers' thoughts. In D.Ashton (ed.), *Management Bibliographies and Reviews*. Bradford: MCB Press.

Stubbart, C.I. (1989). Managerial cognition: A missing link in management research. *Journal of Management Studies,* **26,** 325-347.

Tanaka, J.W., Taylor, M. (1991). Object categories and expertise: Is the basic level in the eye of the beholder ? *Cognitive Psychology,* **23,** 457-482.

Vandierendonck A. (1990). Rule structure, frequency, typicality gradients, and the representation of diagnostic categories. In K.J.Gilhooly, M.T.G.Keane, R.H.

Logie, G.Erdos (eds.), *Lines of Thinking: Reflections on the Psychology of Thought,* Vol.1. Chichester:Wiley.

Walton, E.J. (1986). Managers' prototypes of financial terms. *Journal of Management Studies*, 23, 679-698.

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